

Dual Tabulation Issue in ES&S Voting Equipment



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Exhibited in Election Systems & Software (ES&S) Election Management System (EMS) when used with DS200 voting machine used in precincts, but may also impact other voting machines.

This issue results in a Cast Vote Record data which is different from the aggregated totals.

This issue was discovered in the 2020 General Election in Volusia County, FL.

What are the two tabulations?

- ES&S maintains two tabulations inside the voting machine.
- One is the "Aggregated Tabulation" and consists of only the totals for each candidate.
- The other is the "Cast Vote Record", which has a record for each ballot.

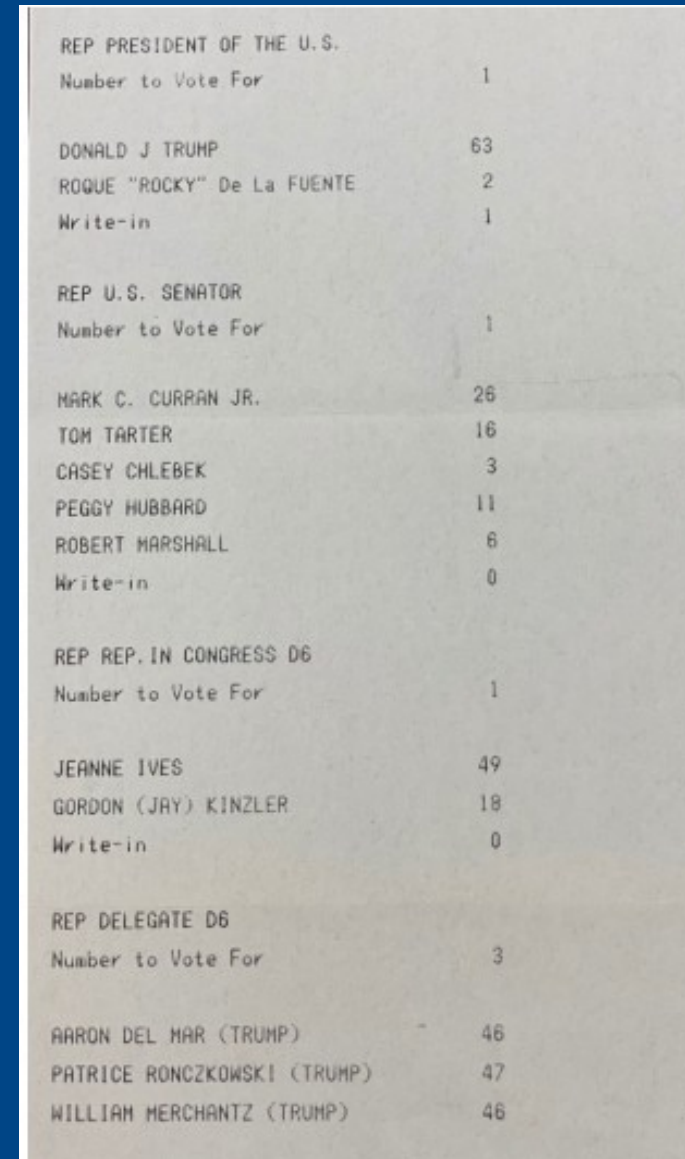
Aggregated Tabulation

- The aggregated Tabulation was the original way the machine would work, by incrementing counters for each candidate as a ballot was processed.
- It is like using clicker counters but implemented in software.
- There is no audit trail to this type of tabulation, and that was a problem.



Aggregated reports

- The machines generate the aggregated report when the polls are closed, printed on a paper tape.
- The early ES&S machines only had this type of report and there was no way to audit the results.



The image shows a paper tape printout of aggregated election results. The text is printed in a monospaced font and is organized into sections for different offices. Each section lists candidates and their corresponding number of votes.

Office	Candidate	Number of Votes
REP PRESIDENT OF THE U.S.	Number to Vote For	1
	DONALD J TRUMP	63
	ROQUE "ROCKY" De La FUENTE	2
	Write-in	1
REP U.S. SENATOR	Number to Vote For	1
	MARK C. CURRAN JR.	26
	TOM TARTER	16
	CASEY CHLEBEK	3
	PEGGY HUBBARD	11
	ROBERT MARSHALL	6
	Write-in	0
REP REP. IN CONGRESS D6	Number to Vote For	1
	JEANNE IVES	49
	GORDON (JAY) KINZLER	18
	Write-in	0
REP DELEGATE D6	Number to Vote For	3
	AARON DEL MAR (TRUMP)	46
	PATRICE RONCZKOWSKI (TRUMP)	47
	WILLIAM MERCHANTZ (TRUMP)	46

Cast Vote Records

- Cast vote records provide a ballot-by-ballot record of the vote.
- This can be used to audit the results because each item in the list should match the ballot that was scanned.
- Not as easy to fudge the results because you have to modify the records and make them look good.

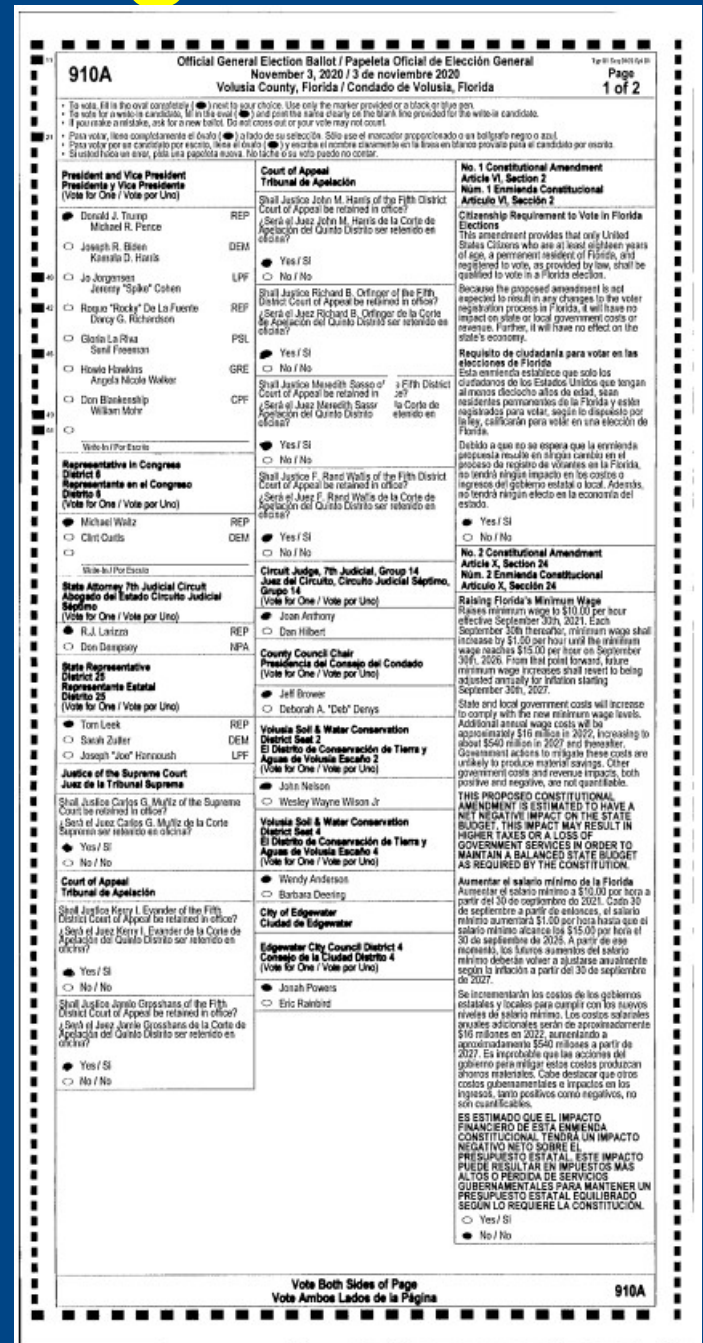
ES&S CVR

- When exported by the EMS, the CVR is provided in a spreadsheet with up to 99,999 records per file.
- The first column is the ballot_id and second is the precinct.
- There is a column for each voting opportunity.
- Example here is a small snip. In the 2020 election, there were 4 files and 69 columns.

Cast Vote Record	Precinct	President and Vice President	Representative in Congress	State Attorney 7th Judicial District
78	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
79	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
80	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
81	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
82	303	REP Donald J. Trump	undervote	undervote
83	301	DEM Joseph R. Biden	DEM Clint Curtis	NPA Don Dempsey
84	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
85	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
86	303	REP Donald J. Trump	REP Michael Waltz	NPA Don Dempsey
87	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
88	303	REP Donald J. Trump	REP Michael Waltz	NPA Don Dempsey
89	303	REP Donald J. Trump	undervote	undervote
90	301	DEM Joseph R. Biden	DEM Clint Curtis	NPA Don Dempsey
91	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
92	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
93	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
94	303	REP Donald J. Trump	REP Michael Waltz	NPA Don Dempsey
95	301	DEM Joseph R. Biden	DEM Clint Curtis	NPA Don Dempsey
96	303	DEM Joseph R. Biden	DEM Clint Curtis	NPA Don Dempsey
97	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
98	303	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
99	301	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
100	301	DEM Joseph R. Biden	DEM Clint Curtis	NPA Don Dempsey
101	303	REF Roque "Rocky" De La	REP Michael Waltz	NPA Don Dempsey
102	301	REP Donald J. Trump	REP Michael Waltz	NPA Don Dempsey
103	301	DEM Joseph R. Biden	DEM Clint Curtis	NPA Don Dempsey
104	303	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza
105	301	DEM Joseph R. Biden	DEM Clint Curtis	REP R.J. Larizza
106	303	REP Donald J. Trump	REP Michael Waltz	REP R.J. Larizza

ES&S Ballot Images

- ES&S first creates images of the ballot, both sides, to create two images per ballot sheet.
- The images are processed by their system to detect marks that denote votes.
- The images are an important record for auditing and should be preserved.
- Some counties in FL are deleting their ballot images despite rules that require that all election data is saved for 22 months.
- Ballot images are recorded to the USB thumbdrives.



Two Tabulations start the same

- Inside a machine, the two tabulations start the same. If you add up the CVR, it will match the aggregated totals.
- But they do not generate the aggregated totals by adding up the CVR.
- Each voting machine only has data for one or a few precincts.
- At the end of the voting period, the polls are closed.
- The aggregated totals, the CVR, and ballot images are written to the USB flash drive that is installed in the machine. These match each other.
- In some areas, the aggregated data is also transmitted by cell modem to the election office so it can be combined with other precincts.
- The USB flash drive is encrypted and hand-carried in a secure pouch to the election office.
- Later, the data from the thumbdrives are read in, including aggregated totals, CVR data, and ballot images.

Combining all the data

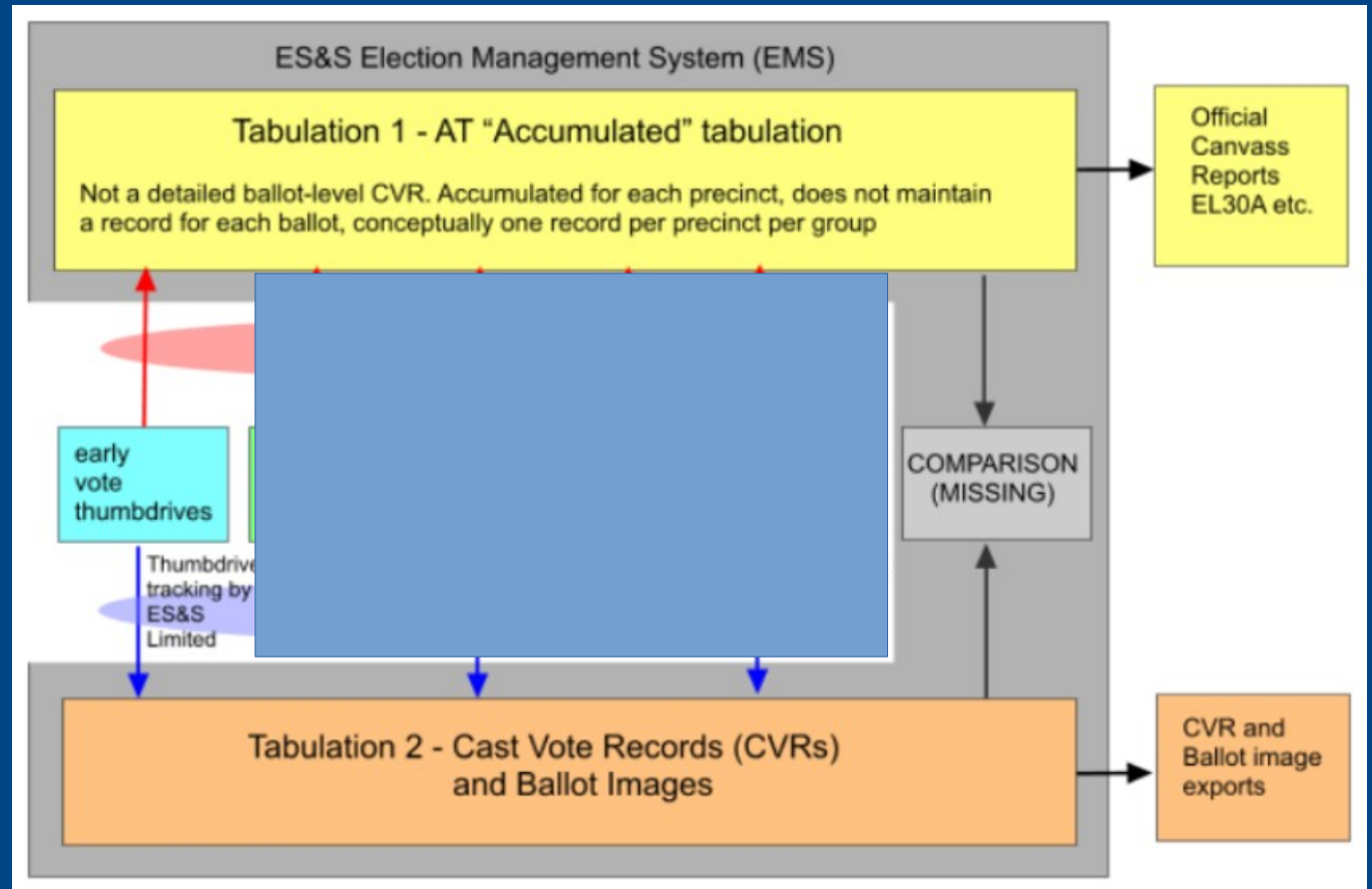
- The aggregated tabulation is read by the EMS software, either from the thumbdrive or possibly from the cell modem transmission.
- This aggregated data is used to create the official tabulation.
- The CVR data and ballot images are not used in the generation of the official canvass results, but exists only for audits.

In 2020 Volusia, FL:

- In Volusia, we found evidence of two types of errors that can cause the CVR and ballot images to differ from the aggregated tabulation.
- Compared with the aggregated tabulation, the CVR can have either more records, which also match the ballot images, or they can have too few records.

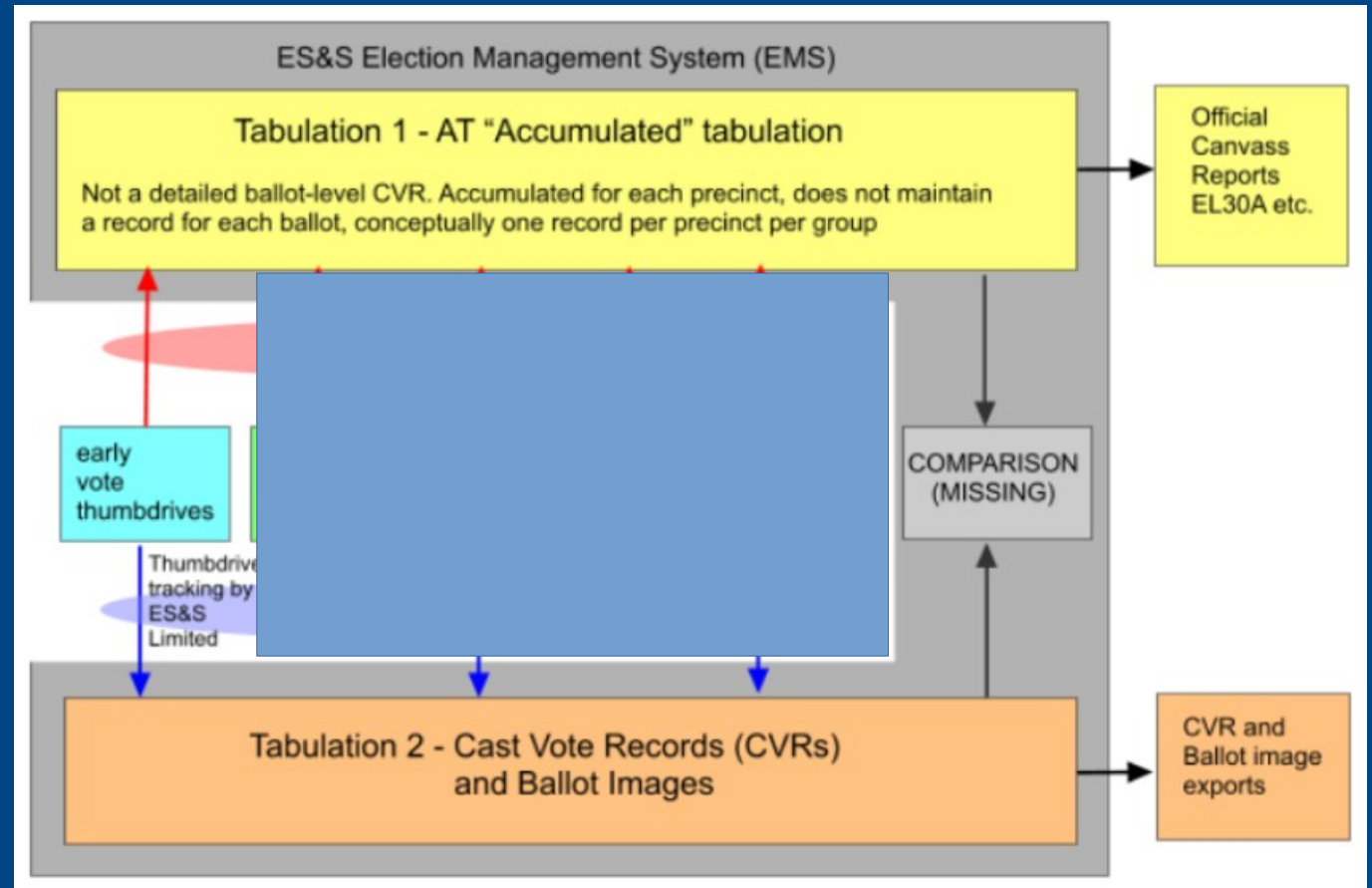
Early voting center USB flash drive data "acquired"

- Prior to election day, the early voting center in New Smyrna beach closed.
- There were several machines at that polling location.
- When the data is acquired, both the aggregated (accumulated) tabulation and the CVRs and ballot images are read.
- We show here the aggregated totals being added to the AT accumulated tabulation at the top
- The CVRs and Ballot images are read also at this time.
- There is no cell modem transmission from the early voting sites.



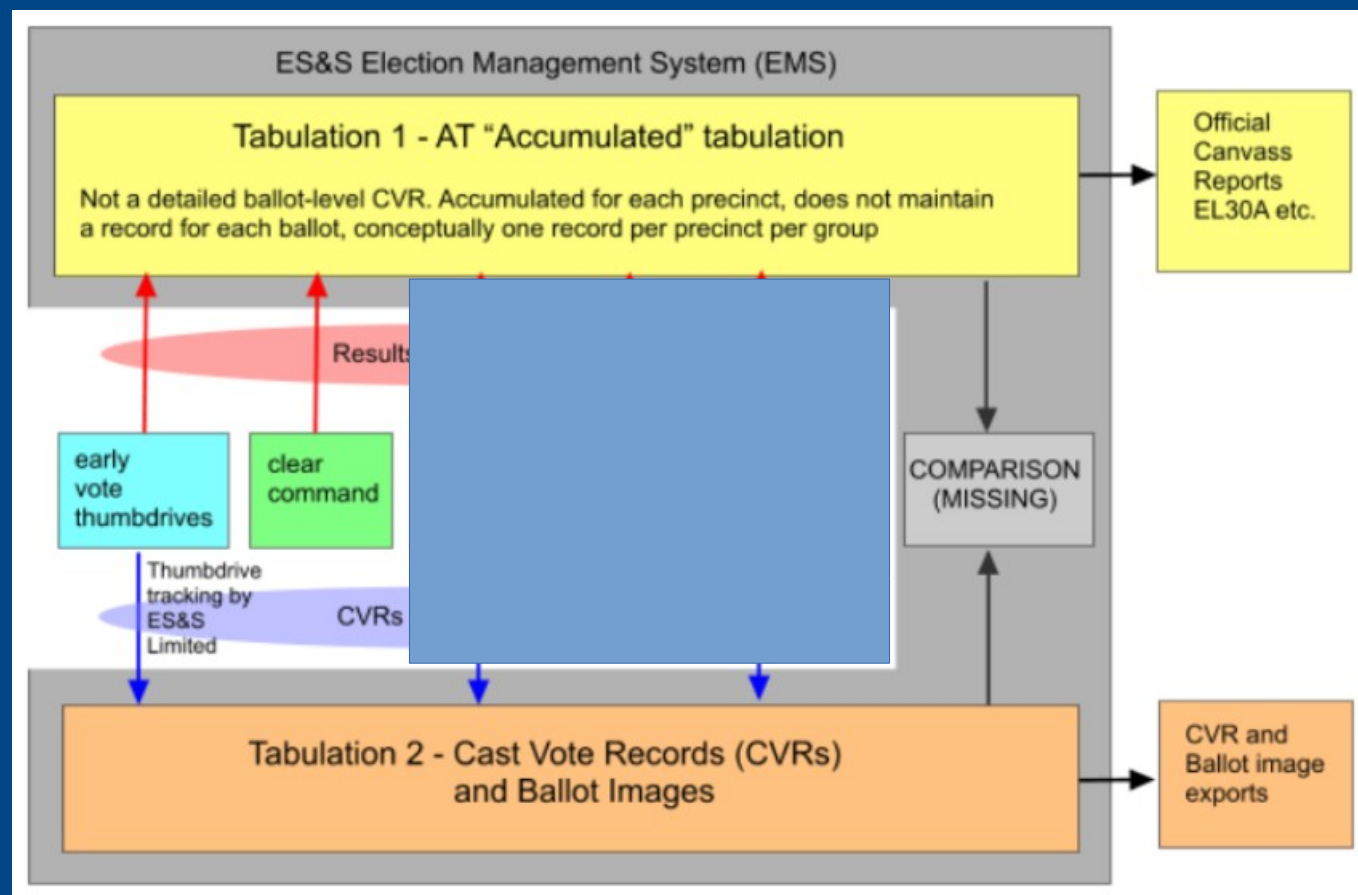
Second USB flash drive failed

- During the upload of the data from the thumbdrives
- The first drive was successful
- But the second drive failed.
- The election officials decided to clear out the election completely and rescan all the ballots from that voting center.
- This was done with full public observation.



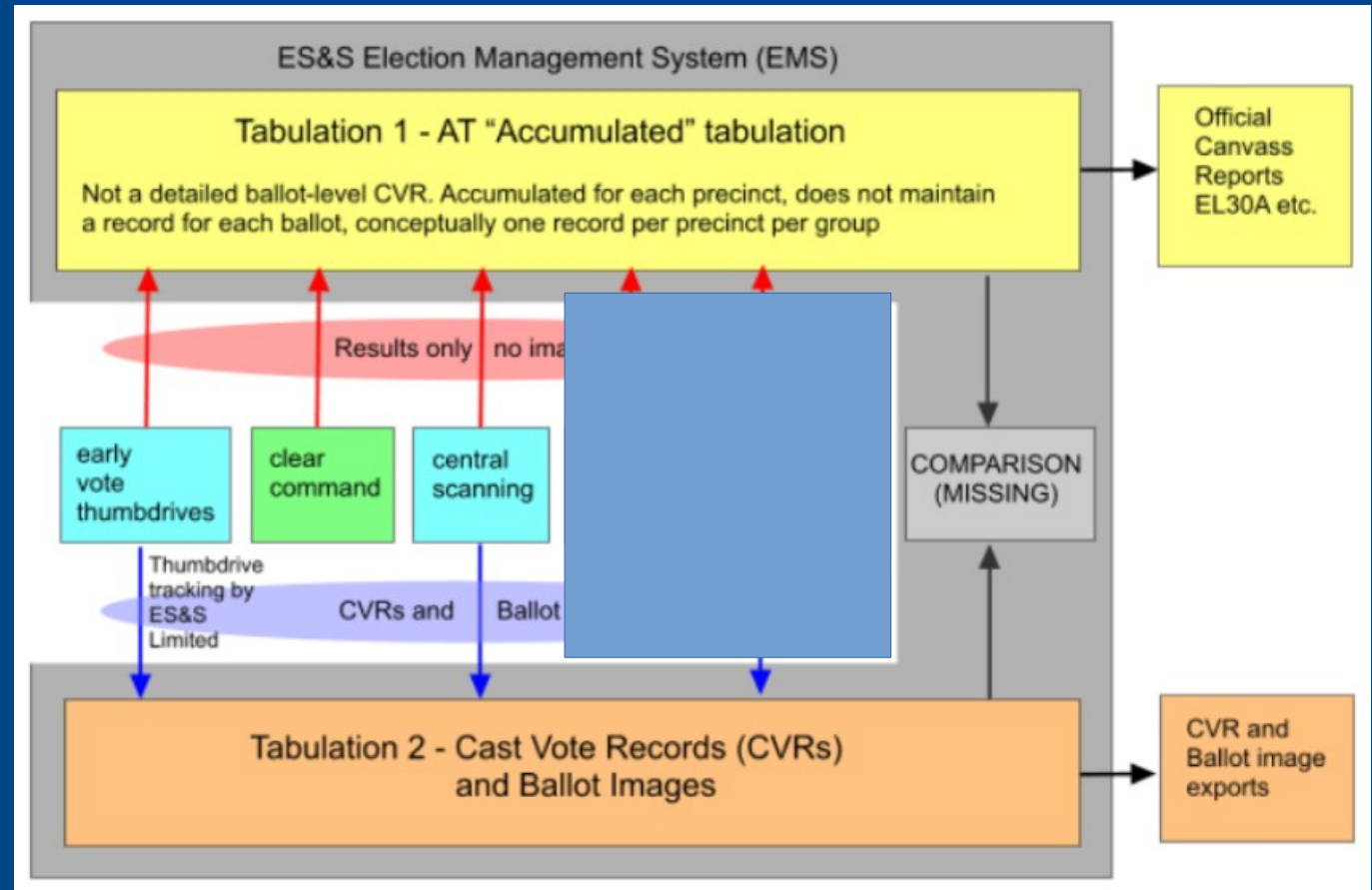
Clear command issued.

- The clear command was issued to clear all the data in the election. But it cleared only the accumulated tabulation and not the CVR or ballot image data.



Ballots were rescanned from the New Smyrna Beach early voting site

- Then, the ballots were rescanned.
- New accumulated totals were created.
- The CVRs and ballots images were added to the ones that were already uploaded.
- This resulted in about 5,000 repeated ballots in the CVRs and Ballot Images.

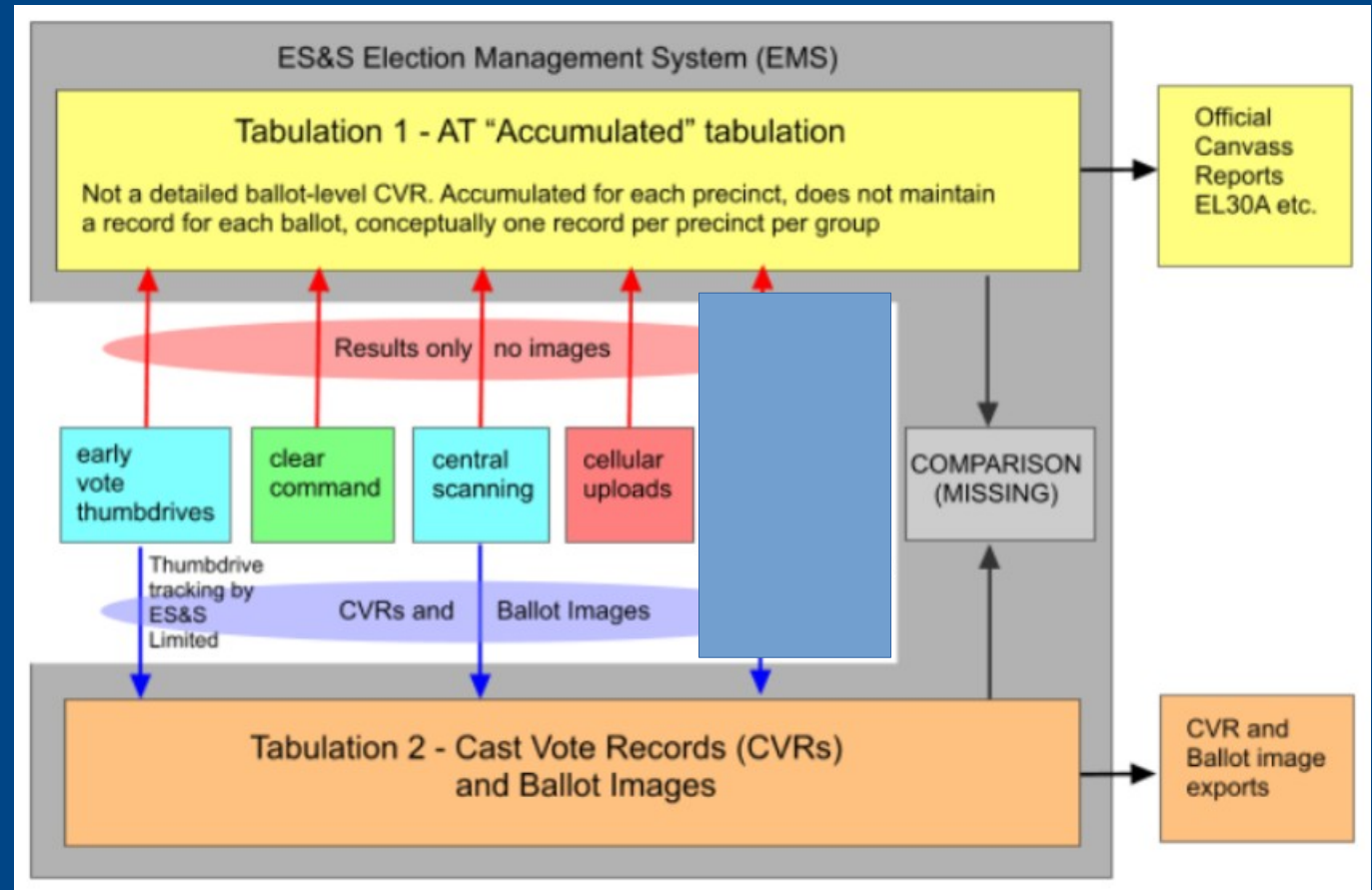


Confirmed repeated ballot images

Ballotid: 151363	Ballotid: 360143
<p>vinculados a la votación en la Florida, no habrá impacto en los impuestos o tarifas gubernamentales.</p> <p>EL IMPACTO FINANCIERO DE ESTA ENMIENDA NO SE PUEDE DETERMINAR DEBIDO A LAS AMBIGUEDADES E INCERTIDUMBRES RELACIONADAS AL IMPACTO DE LA ENMIENDA.</p>	<p>1/5 millones gravado durante 20 años, sujeto a la plena divulgación pública por medio de auditorías anuales?</p> <p><input checked="" type="radio"/> Yes (For Bonds) / SI (A Favor de los Bonos)</p> <p><input type="radio"/> No (Against Bonds) / No (En Contra de los Bonos)</p>
<p><input type="radio"/> Yes / Si</p> <p>.....</p>	<p><input type="radio"/> Yes / Si</p> <p>.....</p>
<p>Volusia Forever: Acquisition and Improvement of Environmentally Sensitive</p>	<p>Volusia Forever: Acquisition and Improvement of Environmentally Sensitive</p>

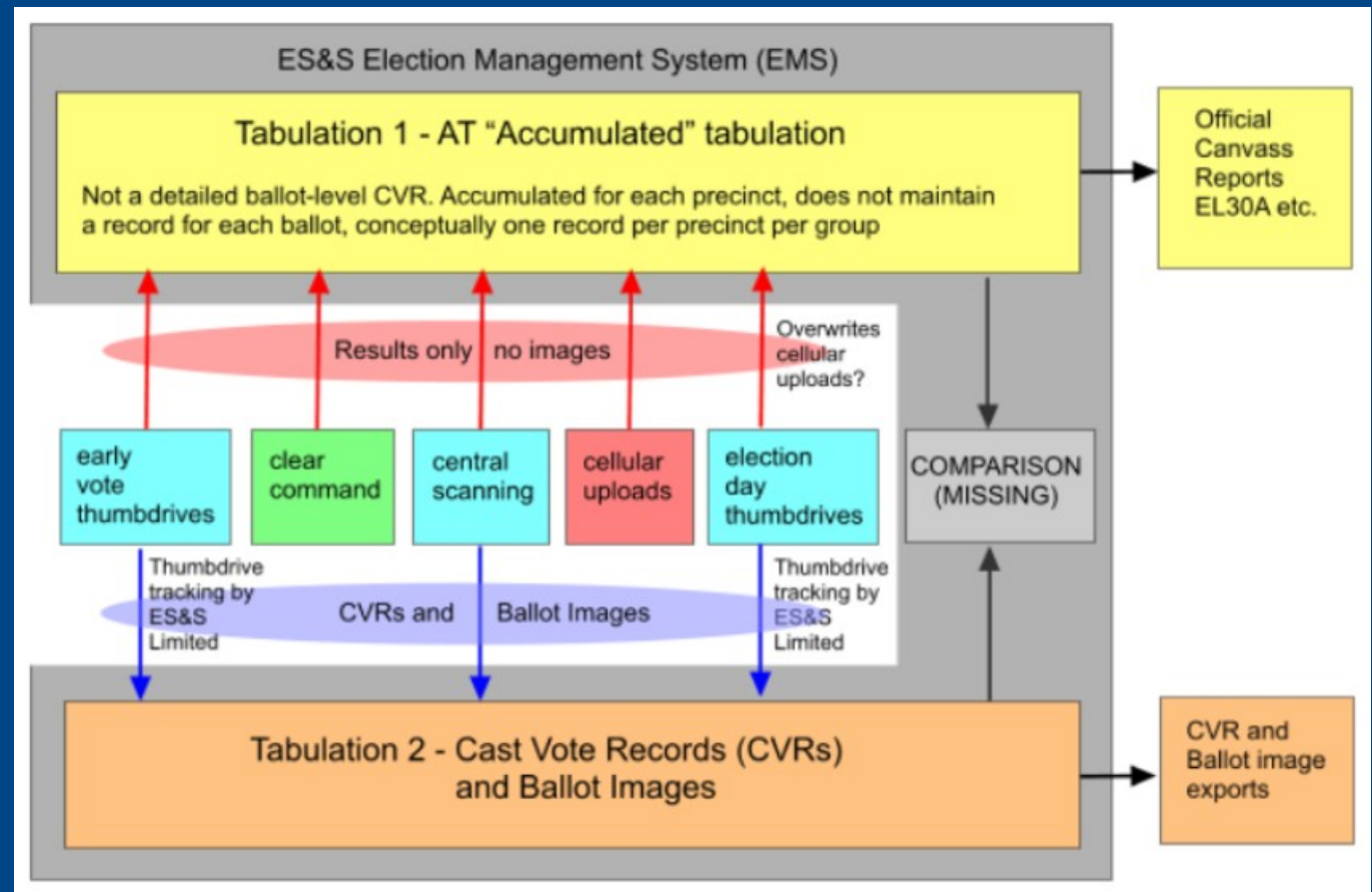
Election day cellular uploads

- When the polls closed on election day, the machines at each polling location transmitted their totals to the election office.
- The cellular uploads do not include the CVRs or ballot images.



Election day thumbdrives are later uploaded

- The election day thumbdrives are uploaded to the EMS later in the process.
- ES&S does not provide adequate tracking of these thumbdrives.
- One of the thumbdrives was inadvertently not uploaded.
- So no CVR or ballot images were uploaded from that machine.



The final CVR and aggregated tabulation differ

- When the ballots were rescanned, it added repeated ballots with different ballot_id numbers for each newly scanned ballot, but the ballots from the first thumdrive already existed because they were not cleared.
- This resulted in about 5,000 repeated CVR records and ballot images, which were of the same physical ballots but where the images were digitally different.

The final CVR and aggregated tabulation differ

- When one thumbdrive was not uploaded, the CVR and ballot images from that machine were not included in the exported CVR and ballot images.
- But the official totals were still correct because they are generated only from the aggregated totals from the machines and NOT the CVR.
- Adding up the CVR and comparing with the aggregated totals may not match and yet there is no error in the canvass result.

Recommendations (ES&S)

- The CVR and ballot images must be manually cleared when the election is cleared.
- Careful tracking of uploaded thumbdrives is necessary.
- Please note that ES&S never compares the CVR to the aggregated result.
- The CVR may not be useful for performing Rank-Choice Voting (RCV). This was encountered in the New York election because the CVR still has data from the logic and accuracy test.
- In any audit, the CVR must be summed and compared with the aggregated official result before it is used.
- Ballot images audits may find correlation with the images, but will detect an issue when the totals from the CVR are compared with the grand totals.
- This issue was detected using AuditEngine ballot image auditing platform.